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TITLE: Method and apparatus for low energy electron enhanced etching and cleaning of substrates in the positive column of a plasma

Detailed Description Text - DETX (8):

In a first preferred embodiment of the present invention, mechanical support 12 is used to mechanically hold sample 16 in a suitable location within positive column 15 in plasma chamber 11, with AC power source 19 and DC power source 26 inactive. In this embodiment, no external voltage is applied to mechanical support 12, and thus sample 16 achieves a "floating potential", which in the case of both a dc plasma and an ac plasma is negative relative to the "plasma potential" in the body of the plasma. In the absence of voltage applied to mechanical support 12, the difference between floating and plasma potential naturally attracts ions 34 from the plasma to sample 16. In the body of the plasma, the density of electrons and ions is on average equal. Therefore in the absence of any external electric fields, or in the vicinity of a perturbation, or disturbance, the plasma is at an equipotential. This is usually called the plasma potential and is sometimes referred to as the space potential. An electrically isolated body, such as sample 16, placed in the plasma will initially be bombarded by electrons and ions. The current density of electrons is much larger than that of the ions and so very quickly the body will collect an excess of negative charge. This repels electrons and attracts ions. The electron flux is decreased so that it just balances the ion flux on the body. At this point the body has reached a steady state of excess charge, electric field and potential. The potential it has reached is called the floating potential, and since it repels electrons it is less than the plasma potential. In the instance of a dc plasma the floating and plasma potentials are negative with respect to the grounded anode. In the absence of a reference potential (e.g. when the plasma is created by ac inductive coupling), only the difference in the plasma and floating potential is meaningful.